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Our Navy's Startling WINDMILL SUBMARINE

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Tells How





..Our New

It can stand on its bow, sit on its stern, spin like a top and tie up at ocean bottom depots or re-supply from other subs

By William Krah

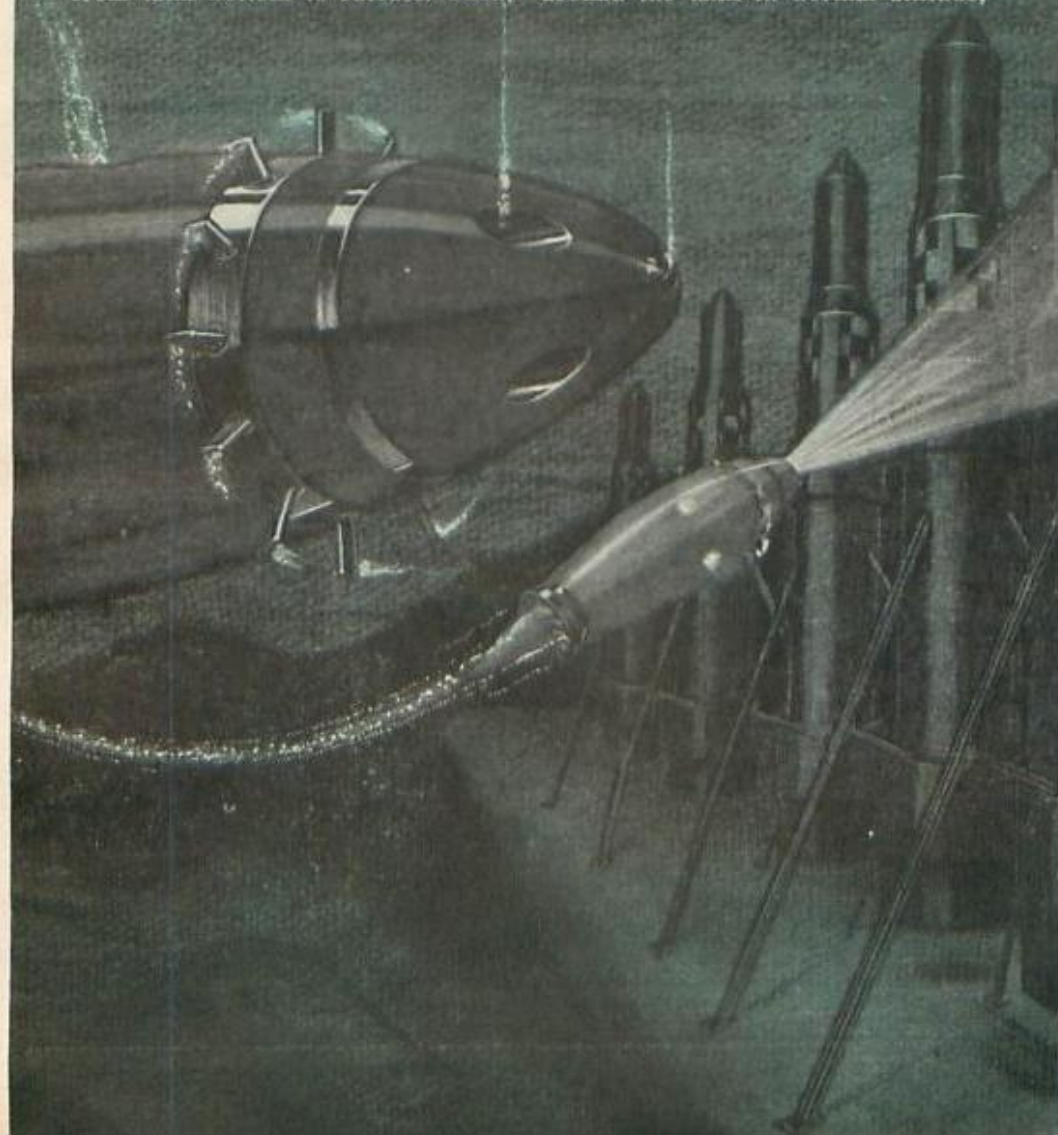
SECRET of new sub, embodied in Cdr. Haselton's 18-foot model (left), is hull-girdling propellers, enabling ship to perform hydrobatics like a helicopter

Windmill Submarine

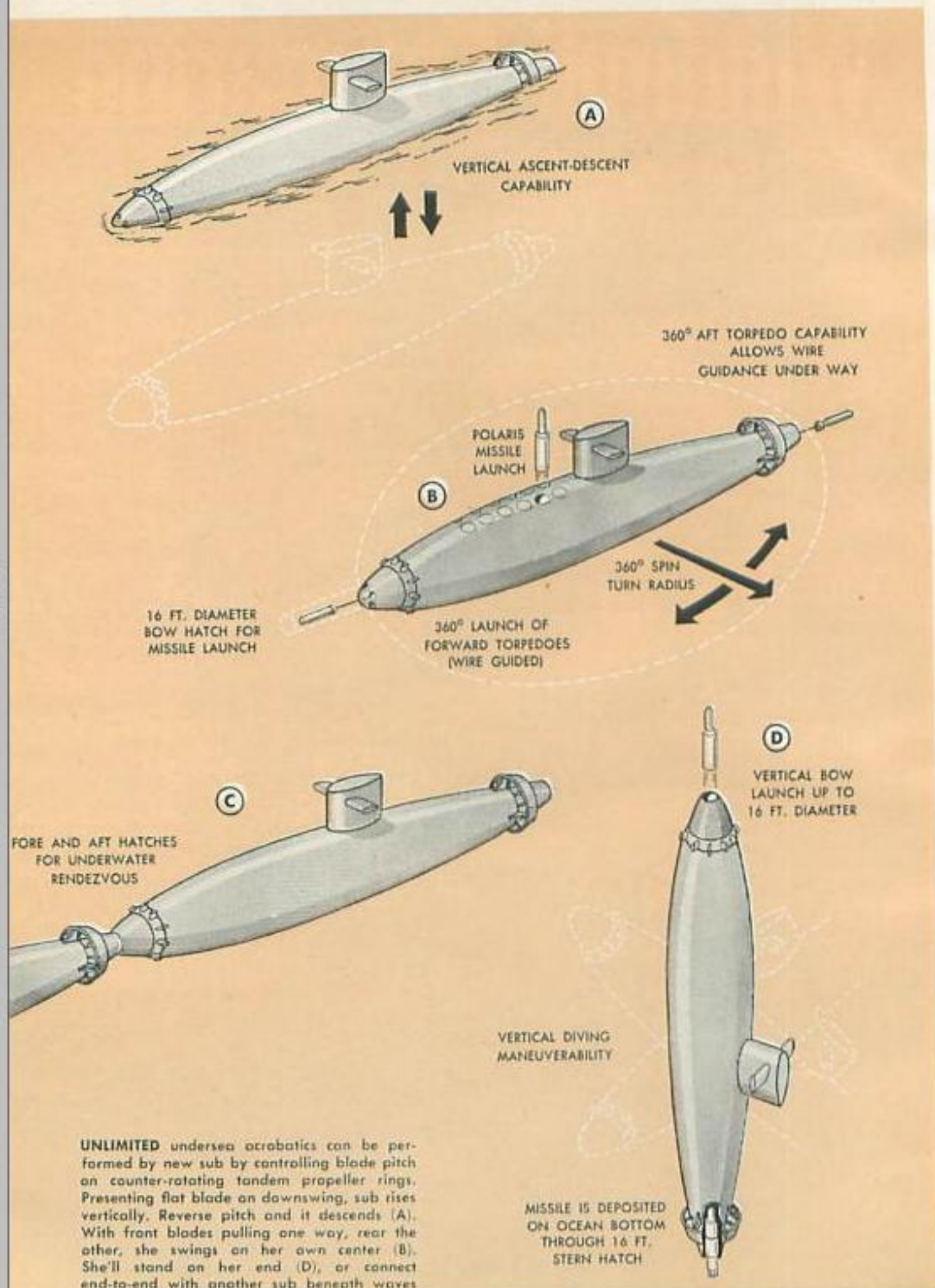
DURING THE PAST few months, Navy experts lining the sides of test tanks have watched an 18-foot model of a wild-looking submarine perform tricks no sub has ever played before.

The sleek, cigar-shaped hull, sporting a ring of whirling blades fore and aft, levitated itself like a helicopter from tank bottom to surface. Then,

without budging forward or backward a single inch, it went to the bottom again like an elevator. It "hovered" at mid-depth, spun on its center in 360° turns. It crabbed sideways, first in one direction, then the other, and indulged in a mad assortment of hydrobatics—such as rolling over, standing on its bow and then on its tail. It also sped around the tank in normal attitude,



FLEET SUBS in the new configuration may deposit missiles in sea-bottom depot through bow or stern hatches; remotely guided TV camera in vessel with same propulsion system can be launched from missile hatch, as shown, and be retrieved



with the agility of a scared rabbit.

The implications of this performance are vast. The giant model may well be the forerunner of a brand new fleet-type sub that will revolutionize submarine warfare techniques.

The vessel will have no rudders or diving planes, yet will dive deeper than ever thought possible. It will be able to stand upright and "plant" missiles on the ocean floor and later inspect and service them. Or it could assume the same position to fire a Polaris missile out of its bow. It will be capable of rendezvousing and connecting underwater with another submarine for rescue work or to exchange crews. It will be able to fire torpedoes from its stern while revolving around its own dead center, giving it a 360-degree range. And its ability to maneuver freely at great depths will open up new vistas in the science of oceanography.

All this will be possible by using a unique new method of propulsion that is now being studied and developed by the Navy. It's called tandem-propeller propulsion and it uses an "inside-out" electric motor completely submerged in sea water.

This submarine of the future will be propelled by two rings around its hull, one near the bow and the other near the stern. Each ring has 18 to 20 blades projecting from it. Each blade, about 2½ feet long, has independent variable pitch.

The hula-hoop-like rings encircling the submarine run in opposite directions. Various combinations of rotation speed and propeller pitch move the craft in any direction, or at any angle, through the water.

Inventor of the new propulsion system is Commander F. R. "Ted" Haselton, USN, a Naval Academy graduate and veteran submarine officer. In his office at the Un-

dersea Warfare Branch of the Office of Naval Research in Washington, D. C., Haselton showed *Popular Mechanics* the first working model of a submarine using his idea. Most of it was built in his own basement workshop a few years ago.

About 25 inches long, the model was operated by the commander in a tropical fish aquarium and was used to convince the Navy that the tandem propeller idea was worth investigating. For a while, his fellow officers referred to Haselton's office as the "Rotor-Rooter Branch." They don't any more.

Today, the Navy is testing an 18-foot all-aluminum model at the David Taylor Model Basin in Carderock, Md. If this craft, designed both for remote control and for driving by a scuba-equipped operator in a cockpit, proves out, a 25-foot television-guided version now on the drawing boards will be constructed for further tests. After that comes a full-sized operational submarine.

Just how does such a submarine work?

"Moving a tandem propeller submarine forward and backward is done the same way as by conventional propellers," Haselton explains. The difference is that my props turn in opposite directions; the torque produced by one offsets the other.

"To go up or down," he continues, "the pitch of each blade is varied during each revolution so that on the downward half of the propeller's cycle, the pitch of the blades is greater than it is on the upward portion. Thus, if the forward unit is rotating clockwise, its blades will have greater pitch while traveling down the right-hand side of the vehicle than they do going up the left side. Therefore, they will produce a force which moves the submarine

(Please turn to page 208)

ROTOR motor for full-scale sub in cutaway at right shows: 1. individually controlled blade; 2. rotating ring; 3. friction bearings; 4. transformer; 5. A.C. field; 6. rotating armature; 7. pressure hull; 8. superstructure hull. How blade control maneuvers sub is shown at the far right

